EVA Suit Studies

Human Forward Contamination Project

EVA Technology Workshop 2017

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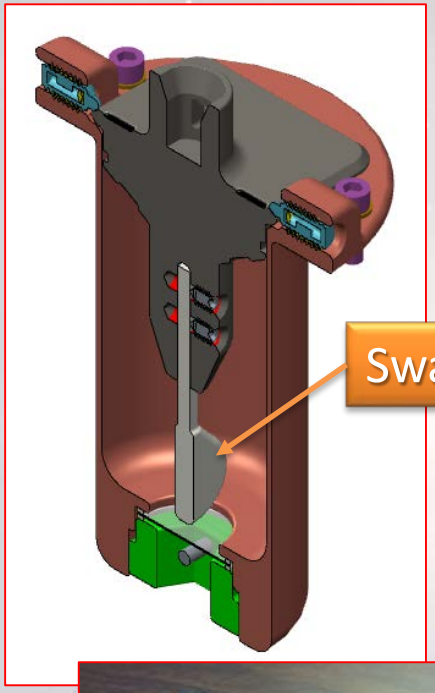
Background

NASA Strategic Knowledge Gap B5
Forward Contamination for Mars

- **Issue: we have knowledge gaps!**
  - Whether/how microbes are released from crewed pressure systems
- **Why do we care?**
  - Informs Mars operational concepts — *How to protect the science*
  - Informs architecture decisions — *How "open" ECLS systems are*
  - Informs landing site selection decisions — How close we can land/operate to where life may be present
- **Project goal: get some data to fill in these gaps**
  - Data will help determine whether we're ready to go to Mars, or if we need to change our systems or operational designs

New EVA Sample Kit
8-Sample Caddy and a Tool Handle



Repurposed Shuttle tile repair hardware!
Dual-action swab end effector release

Tool Form, Fit, Function Test

With a Mark III Suit

Lab Environment (4.3 psid)

Suit joints & vents are the most likely microbial escape paths

- Microbes only need 0.5 to 1.0 µm gap
- Vents can be filtered, but joints can't

Culture Analysis

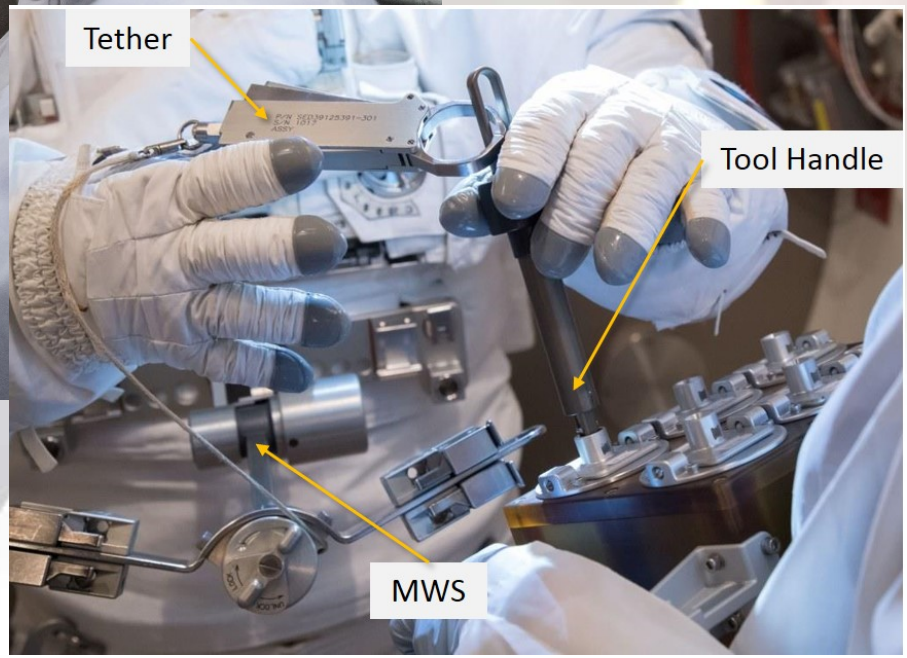
- No fungal spores detected
- Common skin bacteria detected

Space Suit Swab Testing

4.3 psi differential suit pressure

We need to characterize the suits before we send suited crew to sample anything else

Initial tests: did not modify any suit cleaning or handling protocols



Saved cost by piggy-backing onto EMU-suited ISS crew training runs

Sample EMU Swab Test (4.3 psi differential pressure)

Click here to play video

7 test runs to date

Entry Zipper Swab Test (External Vacuum)

Click here to play video

5 test runs to date

Next Steps
Analysis, flight certify the Tool, and Swab ISS

Culture and DNA analysis in progress

- Additional EVA suit ground test "piggy-back" opportunities in FY18
- Will feed results back to suit designers and publish test data

Working with CASIS to identify potential commercial partners
- Two companies have expressed interest in looking for extremophiles outside ISS

From: InnoCentive [mailto:no-reply@innocentive.com]
Sent: Thursday, August 24, 2017 4:44 PM
Subject: Award Announcement for NASA@work Challenge: Submit Your Research Idea to be Conducted on ISS!: Congratulations!
Congratulations, your submission to NASA@work Challenge: 2270 - Submit Your Research Idea to be Conducted on ISS! has been awarded!

Thanks to Lots of Smart People

8 JSC Orgs
- XM, XI, XX, CB, EA, EC, ER, SK

4 NASA Centers
- JSC, JPL, ARC & GSFC

2 External orgs
- SETI Institute and University of Florida

EXTERNAL ORGS		
ORG	NAME	DISCIPLINE
ARC	Brian Glass	Exploration
JPL	K. Venkateswaran	Microbiology
GSFC	Mark Lupisella	Astrobiology
Univ. of Florida	Andy Schuerger	Pathogen Ecology, Planetary Protection
SETI	Margaret Race	Planetary Protection

JSC INTERNAL ORGS		
ORG	NAME	DISCIPLINE
JSC/XM	Michelle Rucker	Exploration, Test
JSC/CB	Stan Love	EVA Crew
JSC/EA4	James Johnson	Planetary Protect.
JSC/EC	Drew Hood	EVA Tools
JSC/EC	Jason Dake	ISS ECLSS
JSC/EC	Joe Chambliss	Exploration ECLSS
JSC/EC	*Mary Walker	EVA Tools
JSC/ER	Bob Shelton	Transport Modeling
JSC/XX	Natalie Mary	EVA
JSC/XX	Chris Vande Zande	EVA
JSC/XI	Mary Sue Bell	Sample Curation
JSC/SK	Sarah Stahl	Microbiology
JSC/SK	Bekki Bruce	Microbiology
JSC/SK	Doug Botkin	Microbiology
JSC/XM	*Alex Horvath	Student Intern
JSC/XM	*Justin Connolly	Student Intern

**Early career/student interns*

Questions?

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